Decreasing Blood Culture Contamination Rates in the Emergency Department

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Decreasing Blood Culture Contamination Rates in the Emergency Department

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Overview of the Problem

- Blood cultures (BC) are an integral diagnostic tool used in the diagnosis of bacteremia
- Emergency Departments (EDs) are commonly the site of initial diagnosis and treatment for bacteremia
- EDs have the highest BC contamination rates compared to other departments within hospitals

(Bool et al., 2020; Halverson et al., 2013; Snyder et al., 2012)
Clinical Significance

- Contaminated BCs lead to unnecessary use of antibiotics, extended length of stay, and additional laboratory testing

- Reducing the BC contamination rate will:
  - Improve patient care and outcomes
  - Decrease costs for hospitals and patients

- Implementation of continued education, BC collection kits, and regular feedback have been associated with a clinically significant decrease in BC contamination rate

(Binary et al., 2020; Bowen et al., 2016; Dempsey et al., 2019; Farrell et al., 2020; Harding & Bollinger, 2013; Marini & Truog, 2013; McLeod, 2019; Overton et al., 2016; Robertson et al., 2015; Snyder et al., 2012)
Clinical Problem

- Despite a national benchmark for BC contamination rate of less than 3%, EDs have reported rates as high as 12.5% in the literature

- BC contamination rates are highly varied in EDs as well, leading to inconsistencies in patient treatment

- EDs serve a diagnostic niche in healthcare, so it is imperative to perform quality diagnostic testing in EDs

(Bool et al., 2020; Doern & DeBaun, 2021; Halverson et al., 2013; Snyder et al., 2012; Sundermann et al., 2017)
Clinical Problem

- EDs have issues specific to them which increase the likelihood of contaminated BCs including:
  - Overcrowding
  - High staff turnover rates
  - Presence of critical patients
  - Expectation to obtain tests quickly

- A need for continued education, adjusted BC collection kits, and regular department-wide feedback was identified for the project site due to high and variable monthly BC contamination rates

(Bool et al., 2020; Doern & DeBaun, 2021; Halverson et al., 2013; Snyder et al., 2012; Sundermann et al., 2017)
Project Purpose and Goal

- **Purpose**
  - To implement a BC collection toolkit consisting of education, BC collection kits, and regular feedback in the ED

- **Goal**
  - To decrease the BC contamination rate in the ED
Guiding Framework:
Lewin’s Evidence-Based Practice Improvement Model

PICOT Question

“In emergency room patients, how does a blood culture collection toolkit compared to no blood culture collection toolkit affect blood culture contamination rates within three months?”
EVIDENCE
Literature Search

Identification of studies via databases and registers

Records identified from:
- CINAHL Search 1: 18
- CINAHL Search 2: 114
- PubMed: 406
- Cochrane Library: 266

Records screened (n = 75)

Reports sought for retrieval (n = 26)

Records removed before screening:
- Duplicate records removed (n = 17)
- Records marked as ineligible by date limits (n = 264)

Records excluded:
- Reason 1: Use of diversion device (n = 20)
- Reason 2: Use of phlebotomy team (n = 2)
- Reason 3: Use of sterile drapes and/or sterile gloves (n = 5)
- Reason 4: No English publication available (n = 5)
- Reason 5: Flow of emergency room (n = 2)
- Reason 6: Diagnostic use of blood cultures (n = 19)
- Reason 7: Poster presentation synopsis (n = 1)

Reports not retrieved (n = 0)

Reports assessed for eligibility (n = 20)

Studies included in review (n = 11)

Reports of included studies (n = 0)

Records identified from:
- Citation searching (n = 3)

Reports sought for retrieval (n = 3)

Reports assessed for eligibility (n = 3)

Reports not retrieved (n = 0)
Critical Appraisal

- All studies were critically appraised using the Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professional Model tools.

- During critical appraisal, a quality grade and evidence level were assigned to all studies to determine the strength of recommendations made from them.
  - One study was a level I, one study was a level III, and nine studies were level V.
  - Five studies were assigned a quality grade of A, while six studies were assigned a quality grade of B.

(Dang et al., 2022)
The evidence found was synthesized in three categories:
1. Research Evidence
2. Clinical Expertise and Non-Research Evidence
3. Patient and Family Preferences and Values

Each type of evidence is needed to implement a well-rounded evidence-based practice project

(Levin et al., 2012)
Two pieces of research evidence were found

- Cervero et al. (2019) showed a statistically significant decrease in BC contamination rate in the ED with individualized feedback.

- Snyder et al. (2012) did not have a clinically significant decrease in BC contamination rate with the implementation of prepackaged BC collection kits alone.

No conclusions could be drawn on the effect of interventions on the BC contamination rate using these studies alone.
Clinical Expertise and Non-Research Evidence

- Most studies found are quality improvement projects (non-research evidence)

- Evidence suggests a clinically significant decrease in BC contamination rate in the ED with a bundled approach consisting of staff education, packaged BC collection kits, and regular feedback to staff collecting BCs
  - Multiple factors contribute to contamination, so research supports the implementation of multiple interventions

(Bowen et al., 2016; Harding & Bollinger, 2013; Marini & Truoq, 2013; McLeod, 2019; Robertson et al., 2015)
Patient and Family Preferences and Values

- Patients must be informed to determine their preference for treatment

- The education to staff qualified to collect BCs will include the need to educate patients on:
  - Why BCs are being collected
  - How BCs are collected

- Patients have the right to refuse BCs but are less likely to when making an informed-decision

(Centers for Disease Control and Prevention, 2022; Melynk & Fineout-Overholt, 2019)
Recommendations for Practice Change

- There is **good** and **consistent** evidence to support implementation of a BC collection toolkit including education, BC collection kits, and regular feedback to staff to decrease blood culture contamination rates in the ED.

- It is recommended the project site implements a BC collection toolkit consisting of all three elements to decrease its BC contamination rate.

(Bool et al, 2020; Bowen et al., 2016; Harding & Bollinger, 2013; Marini & Truog, 2013; McLeod, 2019; Robertson et al., 2015)
Aims for Practice Change

- To have a BC contamination rate in the ED at the project site less than 3% within 3 months of the implementation of the BC collection toolkit.
IMPLEMENTATION
Setting and Population

- ED in a community, not-for-profit hospital located in the southeastern United States

- Serves patients across the lifespan with various illnesses with an average daily census of 115 patients

- Participants included all nursing staff in the ED-including 40 registered nurses, 6 licensed practical nurses, and 16 patient care technicians
  - Approximately 10% of the nursing staff is male and 90% is female
  - Age range for nursing staff is 19-68
Facilitators and Barriers

**Restraining Forces**
- Time/Workload
- Education
- Lack of change culture
- Frequency of feedback

**Driving Forces**
- Communication
- Support from leadership
- Collaboration
- Teamwork of ER staff
- Finances
- Time/Workload

**Planned Change**
- Implementation of a blood culture collection toolkit in the ER
Project Team/Stakeholders

- Key project site team members
  - DNP Student
  - ER manager (Community member)
  - ER educator
- Additional team members
  - Project chair
  - ER nursing staff
- Stakeholders not on the project team
  - Laboratory director
  - ER patients
Implementation Process

Education
• Education was given at skills fairs in October 2022-January 2023
• A pre- and post-education questionnaire was given

Blood culture collection kits
• Kits were made by DNP student
• Kits were stocked in the ED beginning in November

Monthly Feedback
• Feedback was given monthly starting at the end of November through the end of January
• Feedback was posted in a highly visible bulletin board in department
Implementation Timeline

- September 2022: Sought IRB determination
- October 2022-January 2023: PDSA cycles/intervention implementation and data collection
- January-March 2023: Data analysis
- August 2023: Dissemination of findings to stakeholders
Ethical Considerations for Implementation

- The project was granted an IRB review exemption from the UTK IRB and the project site’s IRB
- Project does not involve human subject testing
- No patient or nurse identifiers included in data
- Approval was obtained from the ED administration team for implementation of the proposed project
Limitations to Implementation

- Results may not be generalizable as the sample size was limited and restricted to one ED
- Decrease in BC contamination may not be sustained if correct procedure is not followed
- Post-education questionnaire was not conducted consistently
- The laboratory director was slow to disseminate monthly BC contamination rates
- No causality was proven and no control group used
- Multiple interventions were used
EVALUATION
Measures of Success

- Outcome measures include:
  - Monthly BC contamination rate
  - Knowledge of nursing staff pre- and post-education
Data Collection

- Data Collection
  - Retrospective monthly BC contamination rate for the 3 months prior to implementation and the corresponding 3 months from the previous year
  - BC contamination rates for the 3 months during implementation
  - Note: the pre- and post-scores for the education questionnaire were unable to be obtained

- Data Variables
  - Number of contaminated BCs in the ED
  - Time of collection
Data Security

- Physical copies of monthly report of BCs contaminated in the ED included no patient or staff identifiers
  - Any physical copies of data were shredded at the completion of the project

- Nursing staff were instructed to put no identifiers on pre- and post-education questionnaires

- All data was recorded in UT OneDrive and shared with the UTK statistician via UT Vault
Data Analysis

- Most recent version of Statistical Package for the Social Sciences software
- Descriptive statistics are reported for each variable
- Chi-square test of independence was used to determine:
  - Effectiveness of interventions on the monthly BC contamination rate
Cost Effectiveness and Plan for Sustainability

- Cost effectiveness
  - No additional costs needed for project

- Sustainability
  - Expected to be easily sustainable as interventions were simple, yet effective
  - Project took aspects already present in the ED and utilized resources more effectively
  - Use of the EBPI framework for implementation
FINDINGS
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Emergency Department Blood Culture Contamination Rates

Contamination Rate

National Benchmark

% Contaminated Blood Cultures
Statistics

During project implementation, ED staff collected 646 BCs with only 16 contaminated (2.5% contaminated)

Comparison to 3 Months in the Previous Year

- During the same 3 months the prior year, 6.5% of the BCs were contaminated
- This was a statistically significant decrease in contaminated cultures between the current year and the year prior, $X^2=11.107$, $df=1$, $p<0.001$

Comparison to Immediately Preceding 3 Months

- During the 3 months prior to implementation, 2.9% of the cultures were contaminated.
- This was a clinically significant decrease between 3 months prior to implementation and during implementation, $X^2=0.172$, $df=1$, $p=0.678$
Pre- and Post-education Questionnaire Results

- The short questionnaire utilized pre- and post-education was not given consistently, therefore no statistical analysis was done.
- However...
  - 100% of respondents stated the venipuncture collection kits would be helpful on the pre-test.
  - 90.3% answered “yes” when asked if seeing the department’s monthly contamination rate would be helpful on the pre-test.
IMPLICATIONS FOR PRACTICE
DISSEMINATION PLAN
The final project manuscript will be submitted to the Journal of Emergency Nursing for publication in Fall 2023.

The final project manuscript will also be supplied to the ER administration team as well as the chief nursing officer at the project site for dissemination within the project site.

This PowerPoint will be uploaded into UTK’s TRACE Library.
Questions?
References

- References provided upon request.